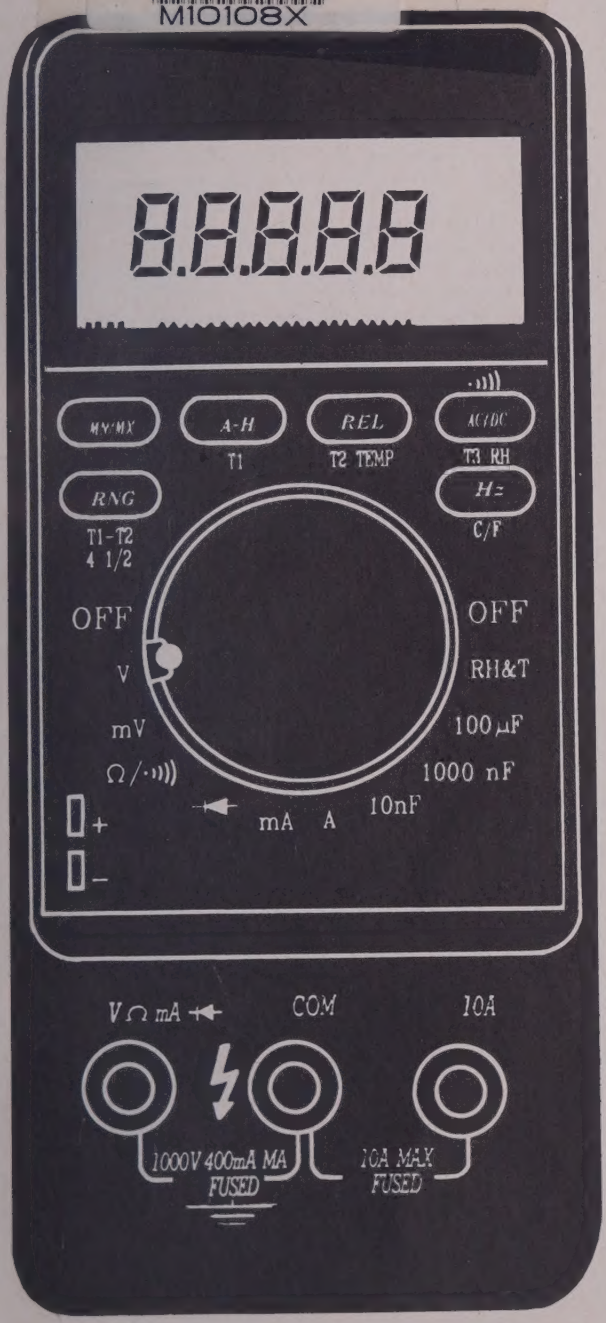
HHM25

Handheld Digital Multimeter / Thermometer and Relative Humidity Meter

Electronic Services - Los Angeles
M10108X



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Operator's Manual
M1520/0992

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OMEGA warrants this unit to be free of defects in materials and workmanship and to give satisfactory service for a period of **13 months** from date of purchase. OMEGA Warranty adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that our customers receive maximum coverage on each product. If the unit should malfunction, it must be returned to the factory for evaluation. Our Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective it will be repaired or replaced at no charge. However, this WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear or which are damaged by misuse are not warranted. These include contact points, fuses, and triacs.

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TABLE OF CONTENTS
HHM25
HANDHELD DIGITAL MULTIMETER/ THERMOMETER AND RELATIVE HUMIDITY METER

SECTION PAGE

SECTION 1 INTRODUCTION 2

1.1 Description 2
1.2 Features of the HHM25 2
1.3 Accessories 3

SECTION 2 OPERATING INSTRUCTIONS 3

2.1 Unpacking 3
2.2 Multimeter Safety 4
2.3 Parts of the HHM25 5
2.4 Rubber Holster and Stand 11
2.5 Battery Installation or Replacement 11
2.6 Fuse Replacement 12
2.7 Using the Multimeter 13
2.7.1 To Change Sleep Mode to Non-Sleep Mode 13
2.7.2 To Change 3-3/4 Display Mode to 4-1/2 Display Mode 13
2.7.3 To use Auto Hold 13
2.7.4 To use the Bar Graph 14

SECTION 3 TAKING MEASUREMENTS 14

3.1 Voltage Measurements 14
3.2 Resistance Measurements 14
3.3 Capacitance Measurements 15
3.4 Frequency Measurements 16
3.5 Diode Testing 16
3.6 Relative Humidity & Dew Point 16
3.7 Humidity and Temperature (32° to 122°F (0° to 50°C)) 18
3.8 Temperature Measurement (T1, T2, T3 & T1-T2) 19
3.9 To Change Auto Range to Manual Range in Volt and Ohm . . 20
3.10 Using Relative Mode 20
3.11 Using the Null Function 21
3.12 Recording the Maximum and Minimum Values 22

SECTION 4 CALIBRATION 22

4.1 RH Calibration 22
4.2 Temperature Calibration 23

SECTION 5 SPECIFICATIONS 24

FOR YOUR INFORMATION

The HHM25 meter has a display which automatically blanks out after 20 minutes of meter inactivity (the display blank-out feature conserves the life of the battery).

If the meter is ON, to "wake" it up from the "sleep state", press any button.

To disable the sleep function, refer to Section 2.7.1.

SECTION 1 INTRODUCTION

1.1 DESCRIPTION

The OMEGA HHM25 is a portable and versatile true RMS multimeter available with a 4-1/2 digit display. Aside from its full DMM functions, an available temperature socket enables three simultaneous temperature measurements. An optional probe measures relative humidity from 5% to 95%. Both the humidity probe and thermocouple adaptor are included in the HHM25-KIT, which also includes a rugged carrying case. The HHM25 measures voltage, current, frequency, capacitance and resistance as standard features. Additional standard features include true RMS, min/max readings, auto range for voltage and resistance readings, relative and zero set, zoom and null capabilities. The front panel display indicates the measurement function, measurement units, thermocouple (T1, T2, T3, T1-T2) or relative humidity probe, display hold, overrange and low battery warning and a bar graph.

1.2 FEATURES OF THE HHM25

- ✓ Measure voltage, current, frequency, resistance, temperature and capacitance.
- ✓ Optional three Type-K thermocouple inputs with differential measurement available.
- ✓ True RMS
- ✓ Auto ranging voltage and resistance
- ✓ Sleep mode (the meter automatically turns off to lengthen the battery life).
- ✓ As well as its usual 3-3/4 digit display mode, the meter can easily be set to the higher resolution (4-1/2 digit mode for voltage and current, and 4-3/4 digit mode for ohms).
- ✓ Temporary hold to concentrate on the probes while the display retains the readings; the beeper will sound to indicate that the measurement is being displayed.
- ✓ Bar graph for an analog interpretation of the digital measurement readings.
- ✓ Three different capacitance ranges.
- ✓ With the optional relative humidity probe, it can measure relative humidity from 10% to 90% and temperature range from 32° to 122°F (0° to 50°C).
- ✓ With the thermocouple adaptor, the meter can measure T1, T2, T3 and T1-T2 in both °F and °C (-328° to 2498°F (-200° to 1370°C)).
- ✓ Relative mode will store a reading in memory - when taking additional readings, the unit will display the difference between the new readings and the stored value.

✓ When range mode is used with relative mode, a user can change to the most suitable null range by pressing the 'RNG' button.

✓ MN/MX can record minimum and maximum values in any measurement.

✓ Tilting stand integral with rubber holster for easy viewing.

1.3 ACCESSORIES

The HHM25 is the standard meter. If you have not ordered the kit (HHM25-KIT) described in Section 2.1, you may order the following as accessories contained in the kit:

DESCRIPTION	PART NUMBER
3-input thermocouple adaptor	HHM25-TC
Relative humidity probe	HHM25-RH
Rugged Carrying case	HHM25-Carrying Case
Type-K Thermocouple	SC-GG-K-30-36-SMP-M

To calibrate the HHM25 for relative humidity measurements, a calibration kit - part number RH25-CAL is available from OMEGA. This kit includes one bottle of saturated salt solution for measuring 33% RH, and a second bottle for measuring 75% RH.

To order additional rubber holsters, the part number is HHM25-Rubber Holster.

SECTION 2 OPERATING INSTRUCTIONS

2.1 UNPACKING

Remove the Packing List and verify that all equipment has been received. If there are any questions about the shipment, please call the OMEGA Customer Service Department at 1-800-622-2378 or (203) 359-1660.

Upon receipt of shipment, inspect the container and equipment for any signs of damage. Take particular note of any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

NOTE

The carrier will not honor any claims unless all shipping material is saved for their examination. After examining and removing contents, save packing material and carton in the event reshipment is necessary.

Confirm that the following items are in the box:

	DESCRIPTION	QTY
If you ordered the HHM25 you also get:	Set of red and black test leads	1
	Rubber holster	1
	9V battery	1
	Operator's manual	1
If you ordered the HHM25-KIT you get:	All of the above items and	
	Type-K Thermocouple probes	3
	HHM25-RH humidity probe	1
	HHM25-TC 3-input Thermocouple adaptor	1
	Rugged carrying case	1

2.2 MULTIMETER SAFETY

WARNING
BE CAREFUL WHEN WORKING ABOVE 60VDC OR 25VAC RMS. THESE LEVELS PUT YOU IN DANGER OF ELECTRICAL SHOCK.

- Make sure that the meter is in good working condition before using it.
- Choose the appropriate function for your measurement.
- Do not work alone.
- Do not touch the thermometer and humidity socket when the test lead is connected to power.
- Do not touch the CAP input socket when the test lead is connected to power.
- Replace damaged leads immediately. The leads should be checked for damaged insulation or exposed metal. Make sure you have test lead continuity.
- When you are measuring current, first turn the circuit power off, then connect the meter to the circuit.
- Always unplug the live test lead before disconnecting the common test lead.
- Make sure that you use all equipment that you want to test safely.
- An open meter fuse can allow dangerous high voltage build-up. Before measuring current transformer secondary or motor winding current, check fuses carefully.

WARNING
DO NOT APPLY MORE THAN 1000V BETWEEN ANY TERMINAL AND EARTH GROUND. THERE IS A DANGER OF ELECTRICAL SHOCK OR DAMAGE TO THE METER.

2.3 PARTS OF THE HHM25

Before using the HHM25, it is important for the user to become acquainted with the different parts of the meter. Figure 2-1 shows the most important parts of the meter. Each of the major parts of the meter is discussed below. Figure 2-2 shows a detailed view of the Liquid Crystal Display (LCD) when you first turn on the meter (all digits are displayed). All items in ( ) are part of the major heading denoted by numbers at the left of the chart.

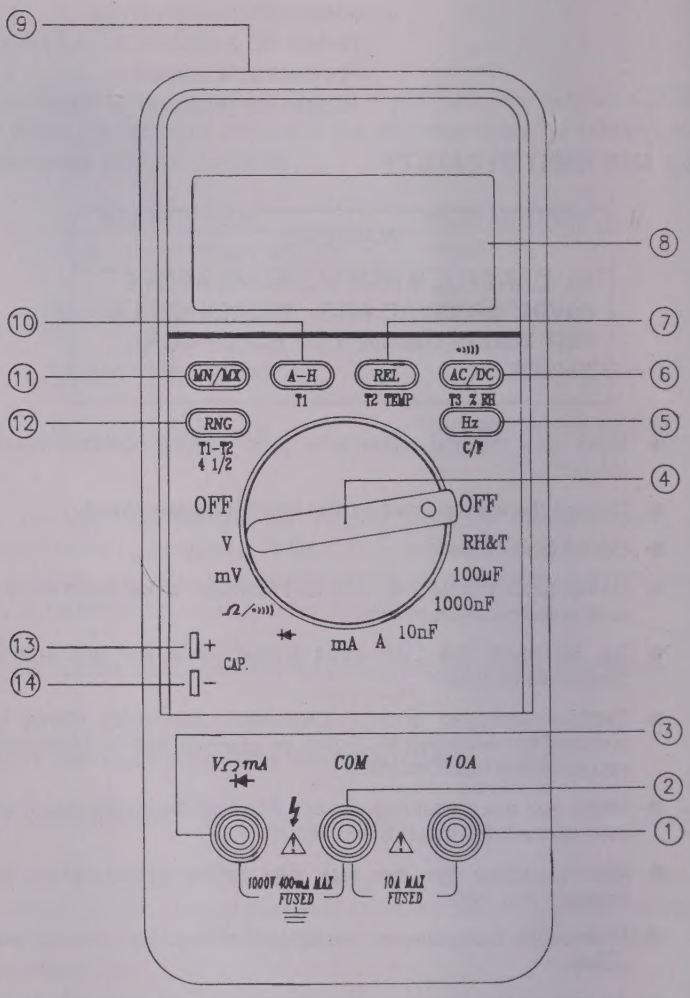

Figure 2-1. HHM25 Meter

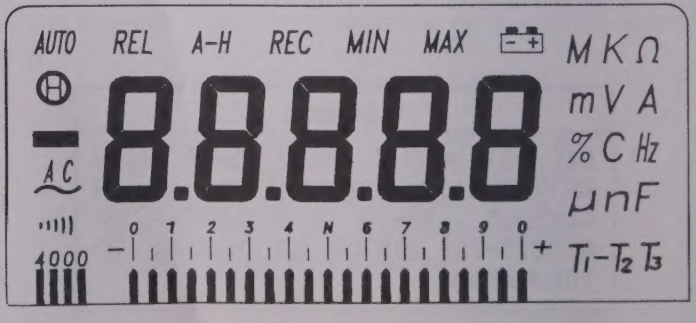

Figure 2-2. Liquid Crystal Display

TABLE 2-1
PARTS OF THE METER

KEY	LABEL	DESCRIPTION & USE
1	10A Fused	10A DC and AC input terminal
2	COM	Common terminal
3	VΩmA	DC and AC volts, ohms, milliamp, diode input
4	Function Dial	ON/OFF and Function selector When the dial is reset to a different function, the beeper will sound to tell you that the function is engaged.
	(V)	Volts AC auto ranging from 0.0001V to 1000V for AC Volts DC auto ranging from 0.0001V to 750V for DC
	(mV)	Millivolts AC and DC auto ranging from 0.01mV to 199.99mV or 0.1mV to 399.9mV
	(Ω/ •ıı)	Resistance auto ranging between 400Ω, 4kΩ, 40kΩ, 400kΩ, 4MΩ, 40MΩ. A beeper for testing circuit continuity.
	(⊣⊢)	Diode test with beeper sounding every 0.5 seconds to indicate that the diode is good.
	(mA)	Milliamps AC and DC auto ranging between 0.01mA and 199.99mA or between 0.01mA and 399.99mA
	(A)	Amperes AC and DC auto ranging from 0.0001A to 10A.
	(10nF)	Capacitance measurement 0.001nF to 9.999nF.
	(1000nF)	Capacitance measurement 0.1nF to 999.9nF.
	(100μF)	Capacitance measurement 0.01μF to 99.99μF.
	(RH&T)	Relative Humidity and Temperature readings
	(OFF)	Power OFF position

TABLE 2-1
PARTS OF THE METER

KEY	LABEL	DESCRIPTION & USE
5	Hz	Recall frequency, change °F to °C or vice versa. - When the function dial is turned to either volt or current measuring position, the meter is in normal measurement mode. If you want to change it to measure Hz, press the 'Hz' button. To switch back to normal measurement mode, press the same button again. - When the function dial is rotated to the RH&T position with the humidity probe plugged in, press the 'Hz' button repeatedly to switch the temperature display between °F and °C
6	AC/DC	Change DC to AC, Continuity Beeper, recall humidity when using humidity probe, recall T3 when using thermocouple adaptor. There are 4 ways to use the 'AC/DC' button: 1. When the meter is first on, it is set to measure DC, but you see no symbol on the display. If you press the 'AC/DC' button, "AC" will show on the left edge of the display which indicates the meter is set to measure AC. To get the meter back to DC again, either press 'AC/DC' button one more time, or turn off the meter and turn it back on. 2. When the function dial is pointed to the OHM position, if you press the 'AC/DC' button, the))) symbol will appear at the left edge of the display. It tells you that a continuous beeping sound will be activated if your measurement of resistance is below 100Ω. 3. When the function dial is set to the RH&T position with the humidity probe plugged in, you will see the relative humidity reading in %. However, if the 'REL' button is pressed (for the temperature reading), to get back to the relative humidity reading you must press the 'AC/DC' button. 4. When the function dial is set to RH&T with the temperature adaptor plugged in, pressing the 'AC/DC' button, displays the temperature reading measured by the T3 thermocouple.

TABLE 2-1
PARTS OF THE METER

KEY	LABEL	DESCRIPTION & USE
7	REL	Relative reading, null function, recall temperature reading when using humidity probe, recall T2 when using thermocouple adaptor. There are 3 ways to use the 'REL' button: 1. Read a value into memory for a differential measurement (refer to Section 3.10) and use of the Null function (refer to Section 3.11). **NOTE** It is a special feature of the meter that it will not suffer overload in Relative mode until the total measured value is over the entire range. 2. When the function dial is in RH&T position with the humidity probe plugged in, press REL. The LCD will display the temperature reading measured by the humidity probe (32° to 122°F (0° to 50°C)). 3. When the function dial is in the RH&T position with the thermocouple adaptor plugged in, press REL. The LCD will display the temperature reading measured by the T2 thermocouple (-328° to 2498°F (-200° to 1370°C)).
8	Display	Liquid crystal; up to 4-3/4 Digit display
	(AUTO)	In auto ranging mode
	(AC)	Alternating current or voltage (NOTE: if you don't see the AC symbol, the meter is displaying DC measurements)
	(–)	Minus sign Automatically registers negative polarity input. In Relative mode, it shows that the present value is less than the one stored in memory.
	(REL)	Relative value: the displayed value is the difference between the present measurement and the stored value.
	(A-H)	The meter is in Temporary Hold mode but has not yet captured and temporarily held a value.

TABLE 2-1
PARTS OF THE METER

KEY	LABEL	DESCRIPTION & USE
	(⊖)	The meter is in Temporary Hold mode and has captured and temporarily held a value.
	(REC)	The meter is in MAX/MIN Record mode. When a higher or lower value is recorded, a beep will sound.
	(MIN)	The minimum value the meter has recorded.
	(MAX)	The maximum value the meter has recorded.
	(▭)	Low battery symbol: the battery is getting low. The meter is powered by a 9V battery; an alkaline battery has a 300 hour life. When this symbol first appears on the LCD, there is at least 6 hours of battery life left.
	(%)	Relative humidity unit of measure
	(T1, T2, T3, T1-T2, and °F or °C)	The temperature measurement for T1, T2, T3 and T1-T2 in degrees Fahrenheit or Celsius.
	(V, mV, A, mA, Hz, Ω, KΩ, MΩ, μF, nF)	These indicators for Volts, Amps, Hertz, Ohms, and Farads are displayed on the right side of the display to show which unit of measurement has been chosen.
	(▮▮▮▮▮)	This analog display appears in V, mV, ohm, mA, A and shows the readings compared to the starting point (at N). The higher readings cause the bars to move to the right and lower readings to the left.
	(OL)	Overload; this indicates that the input is beyond the acceptable range.
9	Socket	Humidity probe and thermocouple adaptor input jack

TABLE 2-1
PARTS OF THE METER

KEY	LABEL	DESCRIPTION & USE
10	A-H	Temporary hold, recall T1 when using the thermocouple adaptor, select beeper option at null mode. - The temporary hold toggle button allows you to hold a value on the LCD display until you are free to look at it. Refer to Section 2.7.3. - When the function dial is on RH&T with the thermocouple adaptor connected, pressing the 'A-H' button will cause the meter to show the T1 measurement. - Press the 'A-H' button, then turn on the meter, and the meter will activate the beeper in Null mode. **WARNING** If You Want To Know If Circuits Carrying Dangerous Voltage Levels Are Dead, Do Not Use The Temporary Hold Option, Since It Will Not Capture Noisy Or Unstable Readings.
11	MN/MX	Record minimum and maximum, change sleep mode to non-sleep mode. There are 2 functions of this button: 1. The meter is set to Sleep mode when you power on, so it will shut off if no button is pressed in 20 minutes. To disable the sleep mode, refer to Section 2.7.1. 2. To record and display minimum and maximum values (see Section 3.12).
12	RNG	Change auto range to manual, change from 3-3/4 digit mode to 4-3/4 digit mode. This button has 4 functions: 1. For special voltage and resistance ranges, refer to Section 3.9. 2. To change the display from 3-3/4 digits to 4-1/2 digits (4-3/4 for ohms), refer to Section 2.7.2. 3. If you press the 'RNG' button when the function dial is set to RH&T with the temperature adaptor plugged in, the LCD displays the temperature difference readings of T1 and T2 (T1-T2). 4. The fourth use of the 'RNG' button is to select null range at the Relative mode. Refer to Section 3.10.

TABLE 2-1
PARTS OF THE METER

KEY	LABEL	DESCRIPTION & USE
13	+	Positive (+) Capacitor input jack
14	-	Negative (-) Capacitor input jack

2.4 RUBBER HOLSTER AND STAND

For protecting the meter, a special rubber holster is supplied with the HHM25. On the back side of the holster you will find a stand. This folds out from the top allowing the meter to stand at a convenient angle for easy viewing.

The humidity probe (HHM25-RH) can be used with the rubber holster. However the rubber holster must be removed from the meter when using the thermocouple adaptor (HHM25-TC).

2.5 BATTERY INSTALLATION OR REPLACEMENT

The HHM25 is designed to use a single 9V battery. The low battery indicator on the LCD appears when it is time to replace the battery (replace the battery as soon as possible since the battery can only last several more hours). To install or replace the battery:

NOTE
IT IS IMPERATIVE THAT YOU REMOVE THE TEST LEADS AND ANY INPUT SIGNALS BEFORE REPLACING THE BATTERY. FAILURE TO DO SO MAY CAUSE ELECTRICAL SHOCK.

1. Turn off the meter. Make sure the test leads are removed from any live source and the test leads are unplugged from the front terminals.

2. Turn the meter over (the display is facing downwards).

3. Remove three (3) screws and separate the case bottom from the case top.

4. Disconnect the battery clip carefully from the old battery.

5. Attach a new battery to the battery clip and insert it carefully into the case.

6. Put the bottom cover back in place (make sure that the leads will not be pinched when the case is closed) and re-install the three screws.

2.6 FUSE REPLACEMENT

NOTE
IT IS IMPERATIVE THAT YOU REMOVE THE TEST LEADS AND ANY INPUT SIGNALS BEFORE REPLACING THE FUSES. FAILURE TO DO SO MAY CAUSE ELECTRICAL SHOCK. BE SURE TO INSTALL ONLY QUICK ACTING FUSES WITH THE AMP/VOLT RATING LISTED BELOW.

1. Turn off the meter. Make sure the test leads are removed from any live source and the test leads are unplugged from the front terminals.
2. Turn the meter over (the display is facing downwards).
3. Remove three (3) screws, and separate the case bottom from the case top. Figure 2-3 shows the inside of the meter at the back.
4. You can see two fuses at the bottom of the PC board near the battery below the shield. The one on the left is 10A. The one on the right is 630mA. Carefully remove the blown fuse that needs changing and replace with a new one of the same size and rating. Two spare fuses are provided. NOTE: DO NOT ATTEMPT TO REMOVE THE BACK SHIELD. THE ACCURACY OF THE METER WILL THEN BE REDUCED.
5. Snap the two halves of the case together and re-install the three screws.

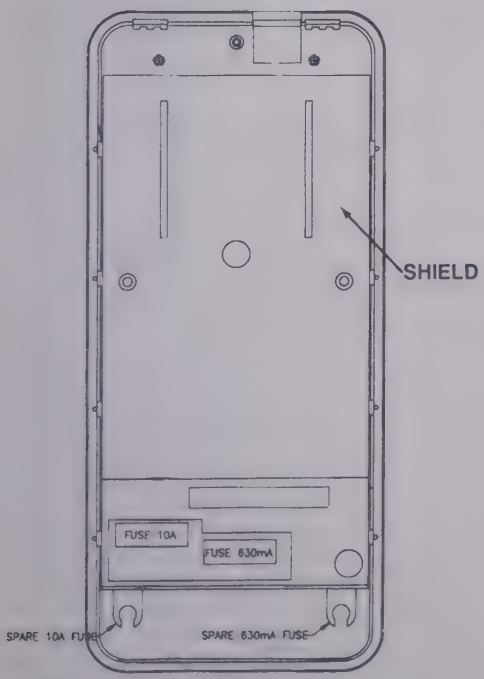

Figure 2-3. Inside Back of the Meter

2.7 USING THE MULTIMETER

2.7.1 To Change Sleep Mode to Non-Sleep Mode

To enable longer battery life, the default mode of the meter is set to sleep mode. The meter will automatically shut off if a button is not pressed in 20 minutes. To wake up the meter again, just press any button. You will find that the meter will operate just as if it was just turned on except that the previous relative setting will be still be in memory.

To disable the sleep function, turn off the meter, press the 'MN/MX' button and hold it in. Then rotate the function dial from the OFF position to any other position. You will first see the full display and then "nS" showing. Now you can release the 'MN/MX' button.

Turn off the meter to disable non-sleep mode and return to the standard sleep mode.

2.7.2 To change 3-3/4 Digit Mode to 4-1/2 (4-3/4) Digit Mode

The meter is set to 3-3/4 digit mode for measurement when it powers on. To power on with 4-1/2 digit mode, press 'RNG' button when the power is off. Hold down the button and turn on the meter by rotating the function dial from the OFF position to any other position. Wait until the LCD shows the full display for one second, then release the 'RNG' button. The meter is now in 4-1/2 digit mode for volt and amp. and in 4-3/4 digit mode for ohms.

If you need the meter to be in 4-1/2 digit mode and non-sleep mode upon powering up, press the 'RNG' and 'MN/MX' buttons simultaneously before turning on the meter. Then rotate the function dial from the OFF position to any other position. Wait for the LCD to show "nS" and then release the two buttons. You are now in 4-1/2 digit mode and non-sleep mode.

Turn off the meter to disable 4-1/2 digit mode.

2.7.3 To Use Auto Hold

When using the meter to measure volts, amps or ohms, you can hold the reading on the display until you are free to look at it. The auto hold ('A-H') button allows you to hold the display.

When the meter is in measurement mode, press the 'A-H' button. You will see "A-H" on the display at the top and the meter will beep. Now the meter is in Temporary Hold mode. Once you have made a measurement and the meter held a stable value, the beeper will sound, and " ⊖ " will appear on the upper-left side of the display. The temporarily held value will stay on the display. As soon as the meter detects a new stable value, the beeper will sound again, and the display will update automatically.

Press the 'A-H' button to disable the auto hold mode.

2.7.4 To use the Bar Graph

At the bottom of the display, you will see some moving bars. The LCD can display as many as 21 bars. The first bar is usually positioned at the extreme left side. This bar is used as the starting indicator for the bar graph and has no other meaning. The other bars are displayed in the sequence from the left side towards the right as soon as the measurement changes. The other 19 bars represent different percentages along with the various numbers of bars displayed. Out of the 19 bars, each bar on the display indicates a multiple of 5 of the digital readings. In 3-3/4 digit mode, the number of meaningful bars displayed on the graph indicates the multiples of the 5 for the second and third digits (reading from right to left) of the present measurement reading. While in the 4-1/2 digit mode, the number of meaningful bars represents the multiple of 5 for the third and fourth digits (reading from right to left) of the present reading.

EXAMPLE:
Assume the present reading is 185.1Ω in 3-3/4 digit mode. The bar graph will show 18 bars. If you switch to 4-1/2 digit mode, the display will show, for example, 185.10Ω, and still show 18 bars. In both modes, the bar graph shows 17 meaningful bars to represent 85Ω.

SECTION 3 TAKING MEASUREMENTS

3.1 VOLTAGE MEASUREMENTS

By connecting the meter in parallel with the load or circuit under test, you can measure the voltage. The meter has a range of 0.0001 to 1000V AC and 0.0001 to 750V DC.

For millivolt measurement, the meter is set to measure 400.0mV in 3-3/4 digit mode. When the meter is in 4-1/2 digit mode, the maximum measurement is changed to 200.00mV.

Press the 'AC/DC' button to toggle between AC and DC. Only when "AC" appears at the left side of the display, will the meter be in AC measurement.

When you measure a voltage as high as 1,000, do not immediately afterwards try to measure a very low voltage, as you risk losing accuracy due to the slight warming of some components.

3.2 RESISTANCE MEASUREMENTS

WARNING

BEFORE TRYING IN-CIRCUIT MEASUREMENTS, FIRST TURN OFF POWER TO THE TEST CIRCUIT AND DISCHARGE THE CAPACITORS. IT WILL BE IMPOSSIBLE TO TAKE AN ACCURATE MEASUREMENT OF THE RESISTANCE OF A COMPONENT IF AN EXTERNAL VOLTAGE IS PRESENT ACROSS THE COMPONENT.

The meter passes a known current through the external circuit or component in order to measure the resistance. The meter notes the voltage drop, then calculates the resistance using Ohm's Law. In-circuit measurement of resistors often shows a different value from the ohms value shown on the resistor's color code.

This is because the resistance which the meter measures is the sum of the resistance through all possible paths between the probes.

In the lowest range (400Ω), resistance in the test leads can reduce accuracy. A standard pair of test leads will yield an error of 0.1 to 0.2Ω. If you wish to determine the size of the error, short the test leads together and the LCD will show the lead's resistance. You can use the Relative mode to subtract the lead resistance from subsequent measurements.

It is important when measuring resistance to ensure that the contact is good between the probes and the circuit to be tested. For this reason, it is crucial that the contact be clean of foreign matter such as flux, solder, oil and dirt.

In most cases, using straight probes will produce sufficient accuracy, but extra precision can be obtained by using clip probes with short leads.

Although the meter will tolerate up to several volts of AC noise, it will cause the LCD to show varying values. It may be possible to reduce the noise by changing the range.

3.3 CAPACITANCE MEASUREMENTS

WARNING

BE SURE NO POWER IS CONNECTED TO THE METER BEFORE MEASURING CAPACITANCE. UNPLUG THE TEST LEADS BEFORE MEASUREMENT.

The meter provides 3 distinct ranges for capacitance measurement to achieve better accuracy and wider range. The capacitance ranges are listed below:

10nF	measurement range from 0.001nF to 9.999nF
1000nF	measurement range from 0.1nF to 999.9nF
100μF	measurement range from 0.01μF to 99.99μF

For measuring capacitors, turn the function dial to 10nF. Then plug the capacitor into the capacitor jack marked '+' and '-' and 'CAP.'. You will see a numerical value on the display which indicates the capacitance.

If "OL" is displayed, rotate the dial to a larger range.

NOTES

IF THE CAPACITOR HAS POLARITY ('+' AND '-' LEADS), INSERT IT PROPERLY INTO THE JACKS.

NEVER PLUG THE CAPACITOR LEADS DIRECTLY INTO THE JACKS IF THE DIAMETER OF THE CAPACITOR LEAD IS MORE THAN 0.03" (0.8MM). THIS WAY YOU WON'T DAMAGE THE JACKS.

3.4 FREQUENCY MEASUREMENTS

WARNING

TO AVOID DAMAGING THE METER WHEN THE POWER IS ABOVE 5V, SET THE DIAL TO VOLTS (V) TO MEASURE FREQUENCY.

If you are measuring a voltage or current and you need a frequency reading, press the 'Hz' button. The LCD will display the frequency in the range of 0 Hz to 499.99 kHz. For frequency below, the display will show 0 Hz. To switch back to normal measuring reading mode, press the 'Hz' button again.

3.5 DIODE TESTING

Performing diode or transistor junction testing, involves plugging the test leads into the VΩmA and COM inputs, then turning the dial to ⊣◂ position, and connecting the test leads across the diode or diodes. If the diode is good, the beeper will sound every half second.

3.6 RELATIVE HUMIDITY & DEW POINT

The relative humidity is the actual amount of water vapor in the air compared to how much it could hold at that temperature. For example, if the relative humidity is 80%, it means the air is holding 80% of the amount of moisture it could hold before becoming saturated (holding as much moisture as it can in the air at a certain temperature).

During the summer months, as the air warms during the day it can absorb more and more moisture. However, as the temperature drops during the night, this cooler air can not hold as much moisture. As it continues to cool, it may reach the point where it is saturated at that temperature, and the humidity is 100%. This critical temperature at which no more water vapor can be added is called the dew point, or the saturation point.

A good illustration showing the relationship between relative humidity and dew point occurs when you have a glass of iced tea in a room. The outside of the glass becomes wet when warm, moist air comes in contact with the cold glass. This air is cooled below its saturation point or dew point, and the water vapor comes out of the air in the form of water droplets on the glass.

Figure 3-1 shows a graph giving the inter-relationships between air temperature (in °F), dew point temperature (°F) and % Humidity.

Figure 3-2 shows a graph giving the inter-relationships between air temperature (in °C), dew point temperature (°C) and % Humidity.

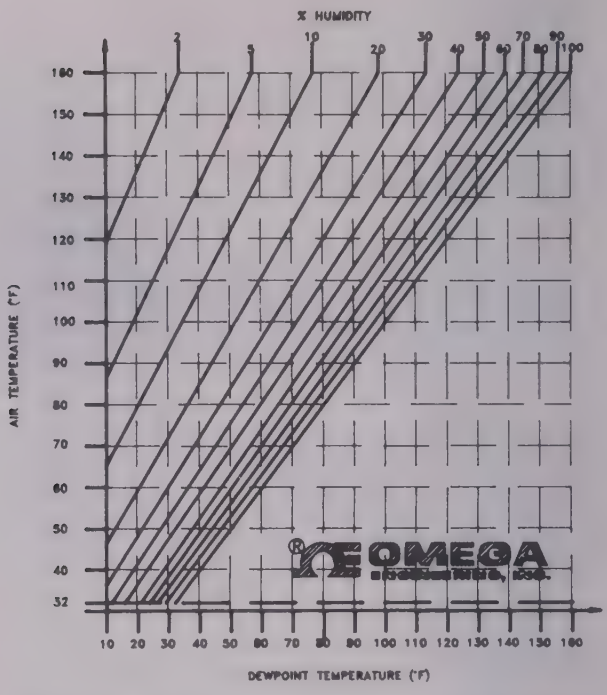

Figure 3-1. Air Temperature / Dew Point / % Humidity (°F)

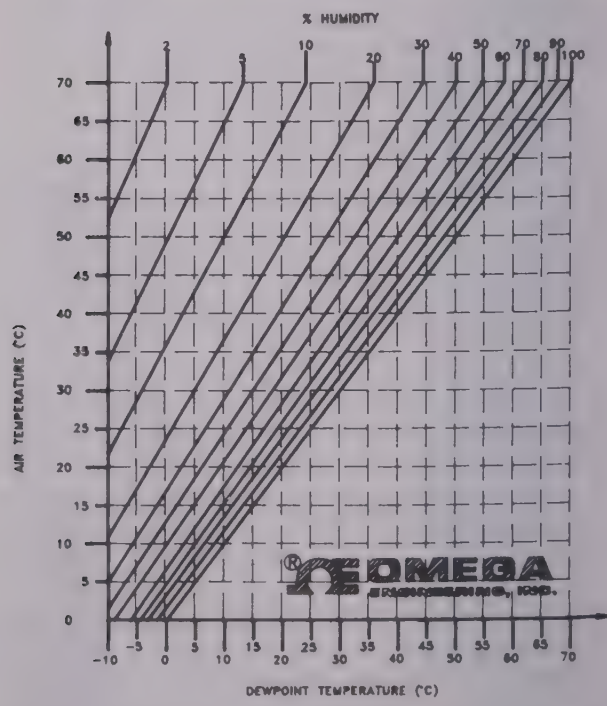

Figure 3-2. Air Temperature / Dew Point / % Humidity (°C)

3.7 HUMIDITY AND TEMPERATURE (32° to 122°F (0° to 50°C))

WARNING

BE SURE NO EXTERNAL POWER IS CONNECTED TO THE METER BEFORE MEASURING HUMIDITY. UNPLUG THE TEST LEADS BEFORE MEASURING.

1. You need the relative humidity probe (HHM25-RH).

2. Plug this humidity probe into the top of the meter. The arrow on the probe connector must line up with the flat edge shown in Figure 3-3.

3. Rotate the function dial to RH&T position.

4. The display shows a relative humidity reading at this point.

5. Press the 'REL' button until you hear a beep and the display is changed to a temperature reading.

6. To change the temperature display from °C to °F or vice versa, press the 'Hz' button until you hear a beep and the display changed to the other units of measurement.

7. If you want to change the display back to the humidity reading, press the 'AC/DC' button.

NOTE

FOR HUMIDITY READINGS, WAIT AT LEAST 5 MINUTES TO LET THE HUMIDITY PROBE GET USED TO A NEW ENVIRONMENT.

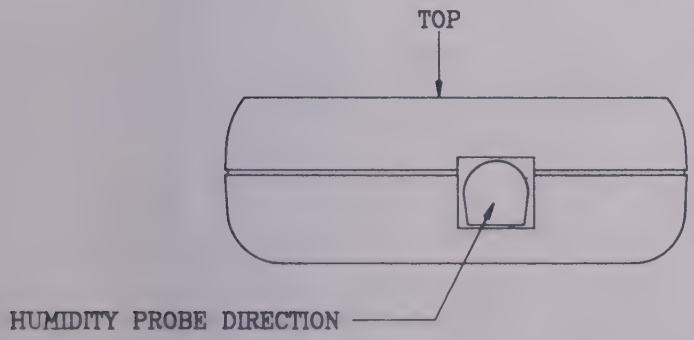

Figure 3-3. Top of the Meter

3.8 TEMPERATURE MEASUREMENT (T1, T2, T3 & T1-T2)

WARNING

BE SURE NO EXTERNAL POWER IS CONNECTED TO THE METER WHEN MEASURING TEMPERATURE. UNPLUG TEST LEADS BEFORE MEASURING.

1. Plug the thermocouple adaptor (HHM25-TC) into position.

2. Plug up to three Type-K thermocouples into the thermocouple adaptor shown in Figure 3-4.

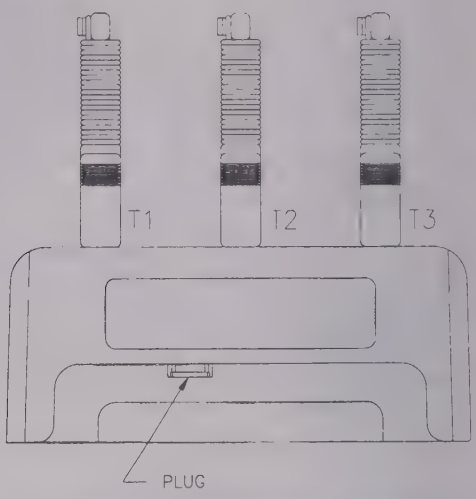

Figure 3-4. Thermocouple Adaptor

3. Rotate the function dial to the RH&T position.

4. The display now shows the temperature reading in °C measured by the T1 thermocouple.

5. To change the temperature display from °C to °F or vice versa, press the 'Hz' button until you hear a beep. (For this step and future steps, you will see a different symbol appearing on the display upon hearing the beep).

6. To change the LCD to the T2 reading, press and hold the 'REL' button until you hear a beep.

7. To show the temperature readings for T3, press and hold the 'AC/DC' button until you hear a beep.

8. To read the temperature readings for T1-T2, press and hold the 'RNG' button until you hear a beep.

9. If the meter displays "-----", this indicates that the thermocouple is not connected.

3.9 TO CHANGE AUTO RANGE TO MANUAL RANGE IN VOLT AND OHM

If you need a special range for measurement, you can press the 'RNG' button to turn off the auto range. Continue to press the 'RNG' button until you get the range you need.

You can set up the meter to be in 4, 40, 400, or 4000 range and in volts or ohms. The "4" and "0's" are displayed in the lower left side of the LCD. If you want to measure the voltage at the range of 40V, press the 'RNG' button to disable the auto range first. Now you see "4" at the lower left side of the display and "V" is displayed on the right side of the display. It indicates the meter is in 4V range now. Press the 'RNG' button again to get the 40V range.

NOTE: There are two exceptions for the voltage range. When the "4000" and "V" appear on the display, it indicates the highest voltage range, but do not measure the voltage over 1,000V for AC or over 750V for DC. The other exception is when the meter is in 4-1/2 digit mode, the "4", "40" or "400" shown on the display represent only 2V, 20V, or 200V for voltage range.

To get back to auto range mode, press and hold the 'RNG' button until you hear two continuous beeps. You will see "AUTO" at the upper left of the display.

3.10 USING RELATIVE MODE

When the function dial is in measuring position for volt, ohm, amp, or cap, pressing the 'REL' button stores the current reading into the memory.

The relative reading mode allows you to read a value into memory. For all new readings, the LCD will display the difference between the new reading and that one in memory. First turn on the meter, take a measurement, then press the 'REL' button to enter relative mode. The present value will be stored in memory, the LCD display will clear to zero, "REL" will appear at the top of the display, and the bar will start to show from "N" position, either to the left of or to the right of "N". This provides a 'Null function'. For more details, refer to Section 3.11. The multimeter will remain in Relative mode until you either: press the 'REL' button again or shut off the meter.

From now on, any new reading shown on the display is the difference between the current reading and the stored value.

Once you set the relative mode, it is always valid even when you rotate the function dial to another measurement position. To disable Relative mode, either press the 'REL' button until you hear the beep or turn off the meter.

3.11 USING THE NULL FUNCTION

If you press the 'REL' button when measuring volts, ohms or amps (not including farads and %RH), the bar shown at the bottom of the display will change its starting position from the left-most to the middle position under the "N". Instead of moving from left to right, the bar will move towards the left or right side away from the "N" when the reading changes. This is called a nulling feature.

Once you are in Relative mode, you can use the 'RNG' button to choose the null range for the relative display, as described below. To achieve the functions described in part 'a' below, press the 'RNG' button one time; for part 'b' below, press the 'RNG' button two times; for part 'c' below, press the 'RNG' button three times; for part 'd' below, press the 'RNG' button four times.

a) In this option, "4" will be displayed at the lower left side of the display. To the right of the "4", a single bar is under "N". It indicates the present reading is the same as the stored value. If the bar moves towards the left of the "N", it indicates the right-most digit of the present reading is smaller than that of the stored value. If the bar moves towards the right of the "N", the right-most digit of the present reading is larger than that of the stored value.

b) In this option, "40" will be displayed at the lower left side of the display. The other displays are the same as in paragraph 'a', but refer to the second digit from the right, not the right-most digit.

c) In this option, "400" will be displayed at the lower left side of the display. The other displays are the same as in paragraph 'a', but refer to the third digit from the right, not the right-most digit.

d) In this option, "4000" will be displayed at the lower left side of the display. The other displays are the same as in paragraph 'a', but refer to the fourth digit from the right, not the right-most digit.

For example: You are measuring a resistance and the display shows 234.56 kΩ. Press the 'REL' button, and the LCD will display 0.00 immediately. Now if the resistance value is 234.60 kΩ, the LCD will show 0.04 and the bar graph at the bottom will show 5 bars (increases by 4 bars) towards the right. If you press the 'RNG' button to enlarge the measuring scale, the "40" will replace "4" at the lower left edge of the display, and the bar graph will show only one bar under the "N". It indicates the difference between the present reading and the stored value is less than 0.1 kΩ. If you press the 'RNG' button again to enlarge the measuring scale to "400" and the difference between the present reading and the stored value is less than 1kΩ. There is still only one bar under the "N".

So you do not always have to look at the display when using the null function, the HHM25 has a built-in audible alarm. To use this alarm feature, press the 'A-H' button before turning on the meter. When using the NULL FUNCTION, the meter will continuously beep when the bar is only under the "N".

3.12 RECORDING THE MAXIMUM AND MINIMUM VALUES

This feature is available for all measurements except the diode test function.

When the meter is in measuring mode, press the 'MN/MX' button until you hear a beep to enable the recording mode. Now you see the "REC" displayed at the upper edge of the display.

The meter will start to record any new max. or min. readings with a beeping sound.

To display the minimum value recorded, press the 'MN/MX' button again. The display will show "MIN" to the right of "REC" and the updated minimum value will be displayed. If you press the 'MN/MX' button again, the maximum value will be displayed with "MAX" to the right.

The display will continue to show the current reading at the REC mode except when "MIN" or "MAX" is displayed.

To disable the recording mode, press the 'MN/MX' button until you hear two beeps. "REC" should disappear from the display.

NOTE

While the meter is in REC mode, it will never go to sleep and the minimum and maximum readings are stored in memory. If you rotate the function knob or press the 'MN/MX' button (until you hear two beeps) to turn off the REC mode, the meter can go to sleep. At this point the meter will not "memorize" the minimum or maximum readings.

SECTION 4 CALIBRATION

4.1 RH CALIBRATION

Equipment required:

1. HHM25 with Humidity probe
2. High and low relative humidity standard such as the RH25-CAL kit
3. Small slotted screwdriver

1. Turn off the HHM25.

2. Insert the probe tip into a sealed RH standard chamber that can measure 33% relative humidity. Be sure the probe is sealed in the chamber opening. A Magnesium Chloride saturated salt solution, such as the one provided in the RH25-CAL kit, provides 33.07% RH vapors at 20°C. Allow this system to stabilize for 45 to 60 minutes.

3. Turn the meter on to the RH&T position. If the display does not match the %RH value shown in Table 4-1 at the ambient temperature, adjust the screw potentiometer P1 until the displayed %RH value matches the value in the table. Figure 4-1 shows the location of P1.

TABLE 4-1
AMBIENT TEMPERATURE / %RH FOR 33% RH

AMBIENT TEMP.	15°C	20°C	25°C	30°C	35°C
%RH	33.3	33.07	32.78	32.44	32.05

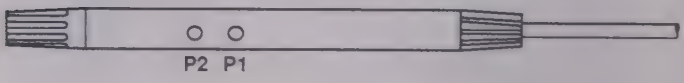

Figure 4-1. Location of Potentiometers

4. Turn the meter off and place probe tip into a sealed RH standard chamber that can measure 75% relative humidity. Be sure the probe is sealed in the chamber opening. A Sodium Chloride saturated salt solution, such as the one provided in the RH25-CAL kit, provides 75.47% RH vapors at 20°C. Allow this system to stabilize for 45 to 60 minutes.

5. Turn the meter on to the RH&T position. If the display does not match the %RH value shown in Table 4-2 at the ambient temperature, adjust the screw potentiometer P2 until the displayed %RH value matches the value in the table. Figure 4-1 shows the location of P2.

TABLE 4-2
AMBIENT TEMPERATURE / %RH FOR 75% RH

AMBIENT TEMP.	15°C	20°C	25°C	30°C	35°C
%RH	75.61	75.47	75.29	75.09	74.87

4.2 TEMPERATURE CALIBRATION

Equipment required:

1. HHM25
2. Thermocouple Adaptor
3. One Type-K Thermocouple
4. Small screwdriver
5. Ice bath

1. Prepare the ice bath.

2. Set up the meter by inserting the Temperature Adaptor in the top of the meter. Install a thermocouple in the T1 slot.

3. Turn the meter on and rotate the function dial to the RH&T position.

4. The display now shows the temperature in °C measured by the T1 thermocouple. If you desire the reading in °F refer to Section 3.8.

5. Be sure the thermocouple is waterproofed before inserting it into the water/ice bath environment. Expose the thermocouple to 0°C, for example, by inserting it into the ice bath. Let the system stabilize. The meter should display 0°C (32°F). If it does not, turn the trimpot in the side of the thermocouple adaptor until the display does show 0°C.

SECTION 5 SPECIFICATIONS

CURRENT (45 to 2000 Hz)	
RANGE	ACCURACY
DC	±(0. 5% of reading + 2 digits)
AC	±(1% of reading ± 2 digits)

MAXIMUM RESOLUTION: 0.1 mA in 400 mA range (3-3/4 digit mode)
0.01 mA in 200mA range (4-1/2 digit mode)

INPUT IMPEDANCE: 10 MΩ (nominal), <100pF

COMMON MODE REJECTION RATIO: >60dB @ DC to 60 Hz

RESISTANCE	
RANGE	ACCURACY
400.0Ω, 4.000kΩ 40.00kΩ, 400.0kΩ 4.000MΩ	±(0.25% of reading + 1 digit)
40.00MΩ	±(1% of reading + 3 digits)

MAXIMUM RESOLUTION: 0.01Ω in 400 ohm range (4-3/4 digit mode)

RELATIVE HUMIDITY

RANGE	ACCURACY
5 to 20%	±7% RH
20 to 90%	±5% RH
90 to 95%	±7% RH

MAXIMUM RESOLUTION: 0.1%

TEMPERATURE (meter only)

RANGE	ACCURACY
-346 to 2498°F	±(0.1% of reading + 1.3°)
-200 to 1370°C	±(0.1% of reading + 0.7°)

NOTE: for differential measurement (T1-T2), accuracy is ±0.1% + 1/8°F (1°C)

MAXIMUM RESOLUTION: 0.1°F or 0.1°C

CAPACITANCE ^

RANGE	ACCURACY
9.999 nF	±1.5% of reading + 10 digits **
999.9 nF	±1.5% of reading + 2 digits
99.99 µF	±2.0% of reading + 2 digits

NOTES: ^ = accuracy with film capacitors or better
** = ±1.0% of reading + 2 digits if Relative mode is used for zero residual

MAXIMUM RESOLUTION: 0.001 nF on the 9.999 nF range

AC VOLTAGE (50 to 60 Hz)

RANGE	ACCURACY
200.0 mV 2 V, 20 V 200 V 1000 V	±(1% of reading + 2 digits)

MAXIMUM RESOLUTION: 0.01mV in 200mV range (4-1/2 digit mode)
0.1mV in 400mV range (3-3/4 digit mode)

AC VOLTAGE (45 to 5 kHz)

RANGE	ACCURACY
200.0 mV	±(1% of reading + 4 digits)
2 V, 20 V 200 V	±(1% of reading + 2 digits)
1000 V	±(2% of reading + 2 digits)

MAXIMUM RESOLUTION: 0.01mV in 200mV range (4-1/2 digit mode)
0.1mV in 400mV range (3-3/4 digit mode)

AC VOLTAGE (5 k to 10 kHz)

RANGE	ACCURACY
200.0 mV	±(2% of reading + 4 digits)
2 V, 20 V 200 V	±(2% of reading + 2 digits)

MAXIMUM RESOLUTION: 0.01mV in 200mV range (4-1/2 digit mode)
0.1mV in 400mV range (3-3/4 digit mode)

DC VOLTAGE

RANGE	ACCURACY
200.0mV, 2000V 20.00V, 200.0V 1000V	0.25% of reading ±1 digit

MAXIMUM RESOLUTION: 0.01mV in 200mV range (4-1/2 digit mode)
0.1mV in 400mV range (3-3/4 digit mode)

INPUT IMPEDANCE: 10 MΩ (nominal), <100pF
NORMAL MODE REJECTION RATIO: >60dB @ 50 or 60 Hz
COMMON MODE REJECTION RATIO: >120dB @ DC , 50 or 60 Hz
OVERLOAD PROTECTION: 600V RMS

FREQUENCY

RANGE	ACCURACY
9999 Hz	±(0.05% of reading + 3 digits)
99.999 kHz	±(0.05% of reading + 2 digits)
199.99 kHz	±(0.05% of reading + 2 digits)

MAXIMUM RESOLUTION: 0.01 kHz on the 499.99 kHz range
1 Hz on the 9999 Hz range

GENERAL SPECIFICATIONS

OPERATING TEMPERATURE: 14° to 122°F (-10° to 50°C)
STORAGE TEMPERATURE: -4° to 140°F (-20° to 60°C)
TEMPERATURE COEFFICIENT: 0.1 x (specified accuracy) per °C (<20°C or >30°C)
THERMOCOUPLE TYPE: Type-K only
RELATIVE HUMIDITY: 0 to 90% (0° to 50°C)
OVERRANGE WARNING: "OL"
POWER REQUIREMENTS: 9V alkaline battery
BATTERY LIFE: 200 hours typical using an alkaline battery for regular measurements. However, when measuring humidity and capacitance, the battery life will be reduced.
LOW BATTERY INDICATOR:
DIMENSIONS: 7.6"H x 3.4"W x 1.45"D (193 x 86 x 37mm)
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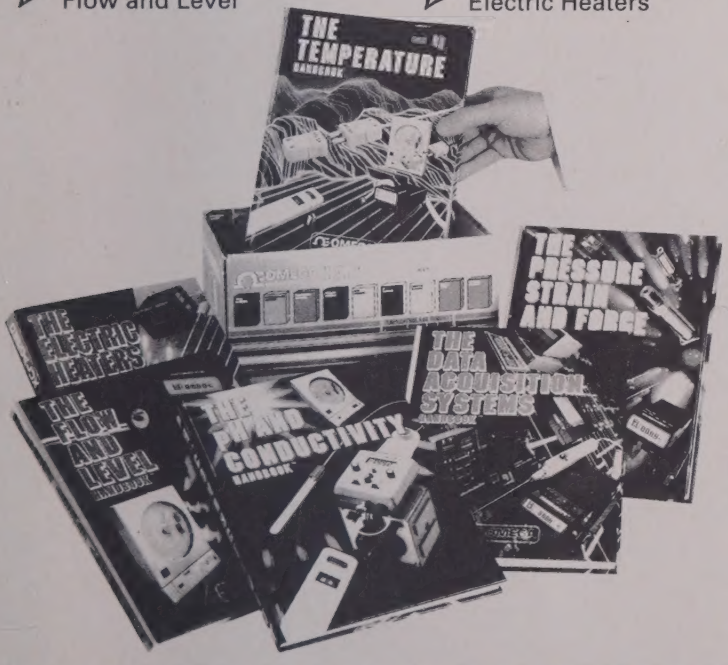
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